

## LATE COMPLICATIONS OF ARTERIAL GRAFTS

P Rutter, John H N Wolfe

### Five main types of complication

- The graft blocks (**ischaemia**)
- Late disruption around the anastomosis (**true and false aneurysms**)
- The graft sends off showers of thrombi (**emboli**)
- The graft becomes colonised with micro-organisms (**infection**)
- An intra-abdominal graft may erode adjacent viscera (usually **aortoenteric fistulas**)

Most complications associated with the insertion of vascular grafts occur after the patient has been discharged from hospital, and so are presented firstly to the general practitioner.

Saphenous nerve damage is relatively common and may result in paraesthesia or numbness on the lower medial thigh. Femoral nerve damage is much less common but more serious, with weakness of the knee flexor muscles. The damage is usually reversible if it has been caused by retraction of the nerve during dissection. Carbamazepine or transcutaneous nerve stimulation may be useful for patients with severe unrelenting symptoms, but in most people symptoms resolve rapidly and reassurance is all that is required.

### Ischaemia



Lower end of PTFE graft anastomosed to the popliteal artery showing stenosis developing at the heel.

The sudden occlusion of a graft should easily be recognised by both doctor and patient. There must be no delay in referral back to the surgeon, particularly if the limb is viable, because a longstanding occlusion can rarely be unblocked; early treatment is the essence of success. A cool, pale, pulseless leg with full movement and early muscle tenderness requires urgent intervention.

The degree of ischaemia that occurs after a graft blocks depends both on the collateral supply and the extent to which the native artery is occluded. Early treatment is essential because delay may result in the loss of the graft and often of the limb as well.

#### Causes

At least 10% of grafts are occluded by five years. The rate increases the more distal the graft, and if synthetic materials are used; more than half of all femorodistal grafts are occluded by five years.

If the cause of occlusion is surgical error (either in operative technique or patient selection) it will happen early—within 30 days of the operation. If a graft occludes between one and 18 months of operation the reason is usually narrowing of the lumen of the graft by neointimal hyperplasia, which is proliferation of smooth muscle and deposition of connective tissue in the intima of the graft. Most occlusions that happen more than two years after operation are caused by progression of the atheromatous disease in the native vessels.

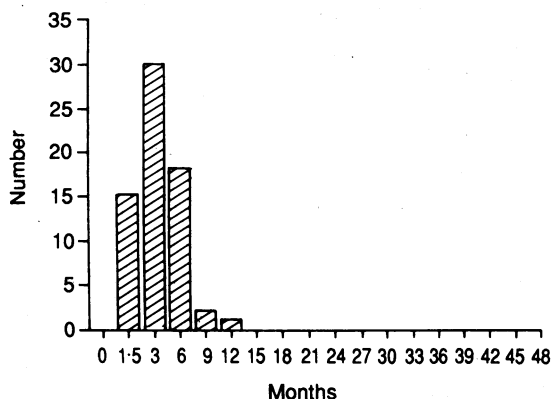
#### Prevention

One recent large study showed that stopping smoking was a more important factor than drug manipulation in increasing survival of grafts. Nevertheless, drugs have a role, particularly in patients with a narrow distal graft, and many patients are discharged from hospital taking either warfarin or aspirin.

Serial non-invasive surveillance of infrainguinal bypass grafts is now recommended. Doppler techniques can identify grafts at risk by showing low flow in the graft and by localising stenoses within the graft and early detection and treatment can significantly increase long term patency.

#### Diagnosis

Recurrence of the symptoms that were present before the operation suggests occlusion of the graft. For example, in a patient with claudication who initially has an improved walking distance but then returns to the preoperative distance or less.



Number of grafts that develop new stenoses according to time after surgery.



Early stages of graft thrombolysis with streptokinase. Note that patency has been achieved but lysis of residual clot remains unnecessary.



Right lower leg showing incisions for "jump graft" from vein graft with distal stenosis to the posterior tibial artery at the ankle.

Patients usually present with rest pain but painless gangrene of the extremities with serious tissue loss is seen too often.

Physical examination should concentrate both on the tissues and the arteries supplied by the graft. If the collateral arterial supply is adequate for the tissues at rest then no skin or neuromuscular changes are seen. If the occlusion is causing critical ischaemia then the limb is cold, becomes pallid when it is raised, and capillary return is slow.

Before examining the pulses both in the graft and distal to it, it is essential to know what happened after the operation. The discharge summary should state whether the pulses were palpable or could be located only with a Doppler probe.

The pulse can usually be felt in a functioning subcutaneous vein graft so a patient may have a functioning graft (associated with severe distal atheromatous disease) but be without a palpable peripheral pulse. Synthetic grafts are not usually pulsatile.

#### *Education of the patient*

Patients should be told to return to the vascular surgeon immediately if there is a sudden change in symptoms. Too often they present late, when the graft is irreversibly blocked. They should also be taught to monitor their own grafts or distal pulses if these can easily be felt.

#### *Management*

The first consideration is the condition of the limb. Irreversible ischaemia or infarction means that immediate amputation is the only option. Misguided attempts at revascularisation may result in fatal cardiac or renal toxicity. On the other hand the combination of graft failure and an unthreatened leg may not require further intervention.

If intervention is required it must be early, because the success rates of simpler methods of graft salvage (surgical thrombectomy or angiographic thrombolysis) decrease with delay. Graft failure that is recognised immediately responds well to thrombolytic agents such as streptokinase or tissue plasminogen activator. The local stenosis can then be recognised and a localised operation carried out. Thrombolytic drugs should not be used, however, if the limb is acutely ischaemic with no movement or sensation and muscle that is probably dead. Such a limb requires immediate thrombectomy and, under these circumstances, intraoperative arteriography should identify the cause of failure and help plan the revascularisation.

## True and false aneurysms



Arteriogram showing the aneurysm of aorta that has developed 10 years after insertion of the original infrarenal graft.



Computed tomogram showing false aneurysm of abdominal aorta between abdominal aorta and aortic graft (arrowed).

#### *Causes*

Anastomotic aneurysms result from a partial or total separation of the anastomosis between the artery and the vascular graft, which are then connected only by a fibrous capsule. They arise after breakdown of the suture line between the graft and the arterial wall, either because the graft or the sutures fail or because the arterial wall is destroyed by infection. Improvements in modern sutures and grafts mean that most aneurysms are now caused either by technical errors such as excessive graft tension or poor placement of sutures, or by infection of the graft. Occult infection is now appreciated as a more common cause of graft aneurysms than was previously supposed.

The incidence of anastomotic aneurysm has been estimated at between 1% and 4% and the most common site is the lower end of an aortobifemoral graft.

#### *Diagnosis*

Most anastomotic aneurysms are asymptomatic, although some may cause symptoms by pressing on local structures.

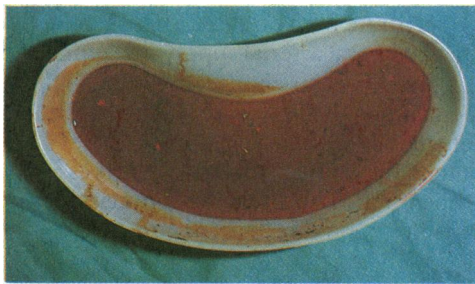
If the aneurysm is superficial it can be palpated easily. A chronic, non-pulsatile swelling at the site of an anastomosis is more likely to be a collection of lymph (lymphocele).

#### *Management*

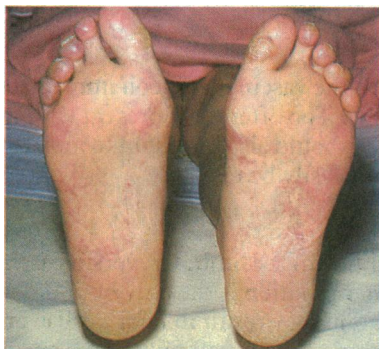
Anastomotic aneurysms should be repaired, and usually a short segment of bypass graft is required, but the operation may be unexpectedly complex. Although small aneurysms can initially be treated conservatively, the risk of rupture increases as they expand.



## Emboli



Dish containing blood from initial flush of an aortic graft. This shows a considerable amount of debris that might embolise to the legs.



Feet showing postoperative cutaneous emboli.

Most emboli are thromboembolic and are more common in large calibre proximal grafts, particularly those inserted for aneurysmal disease. Septic emboli are less common and originate from prosthetic grafts. Most emboli from grafts occur immediately after the operation, and the incidence from grafts that have been in place for more than a month is low.

### Diagnosis

The symptoms depend on the site at which the embolus lodges distal to the graft and on the size of the embolus. Patients with emboli to intra-abdominal organs such as the gut or kidneys may present with either pain or organ failure. More commonly the emboli lodge in the limbs and cause symptoms varying from the pain of severe ischaemia to small areas of skin infarction.

Acute ischaemia caused by an embolus occluding a major vessel can result in the classic "five Ps": pale, painful, pulseless, paraesthesia, and perishing (with cold). Small emboli may lodge in the skin and cause characteristic clusters of petechial lesions.

### Management

Balloon embolectomy is the best treatment for thromboemboli as the older organised clot and sections of pseudointima that make up most of these emboli do not respond well to thrombolytic drugs. But as showers of emboli also lodge in the more distal vessels adjunctive thrombolysis may help. In some cases further bypass is necessary to vessels beyond the occlusions. Septic emboli must be treated by removal of the infected graft and treatment with antibiotics.

## Infection



Petechial emboli in patient with an aortic graft infected with staphylococci.

One of the main drawbacks of modern prosthetic grafts is their susceptibility to infection, and manufacturers are currently attempting to protect the material with antibiotic coating. Infections occurring more than 30 days after operation may be difficult to detect because there may be few organisms of low virulence. The consequences can, however, be disastrous.

When the graft is within the abdomen the incidence of infection is low. If the graft extends into the groin, however, the incidence increases (by 2-3%), particularly if there has been a collection of blood, serous fluid, or lymph.

### Causes

The most common cause of infection is contamination of the graft at the time of operation, but other sources of infection are contaminated blood and lymph. Femoral incisions necessitating disruption of lymphatic channels are particularly susceptible if there is distal infection or gangrene. Any patient with a prosthetic graft who develops bacteraemia or lymphadenitis should therefore be treated promptly with antibiotics to minimise the risk of colonisation of the graft.

Cellular adherence and turnover on a prosthetic graft do not cease, so that any transient bacteraemia can lead to late graft infection. Suitable prophylaxis should therefore be arranged for any invasive procedure such as tooth extraction or cystoscopy.

### Diagnosis

There may be systemic signs such as fever, but rigors are uncommon. There are often no local findings but non-specific malaise in a patient with a prosthetic graft should arouse suspicion of infection.

The infection may drain through a sinus in the wound. If the graft is placed subcutaneously palpation may indicate the presence of an aneurysm in the inflammatory mass. Skin petechiae distal to the graft are a rare but diagnostic finding.

No investigation shows both good specificity and sensitivity. A raised erythrocyte sedimentation rate is almost always present but is non-specific. The white cell count is raised only if the infection is caused by virulent organisms. Once the patient is in hospital computed tomography and angiography are usually carried out, but scanning of indium labelled white cells is the most sensitive test at present.



Left groin abscess: the herald sign of graft infection.



Localised graft infection in the right groin treated with continuous gentamicin infusion.

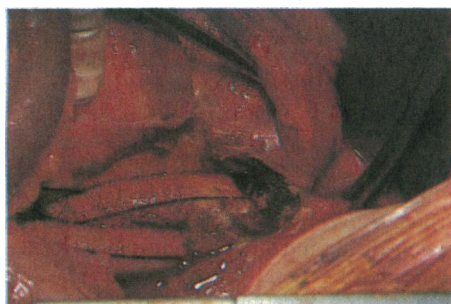
### Management

The principles of management are removal of the infected graft, debridement of infected tissue, and treatment with antibiotics. Immediate revascularisation with a new graft should be avoided, but when it is essential (such as after removal of an aortic graft) the graft should be extra-anatomical—for example, axillofemoral—to avoid the bed of the infected graft. Under specific circumstances irrigation of an infected prosthesis with antibiotic solution may be effective.

## Aortoenteric fistulas



Diagnostic free gas in the aortic sac on computed tomography. The patient had an episode of melaena, giving the diagnosis of aortoenteric fistula.



The infected graft lying in small bowel contents and the clot from the aortoenteric fistula.

Most aortoenteric fistulas present months or years after the initial operation and the incidence is between 0.4% and 4%. When the centre of the graft erodes into the gut, digestion of the fibrous tissue surrounding the graft causes slow seepage of blood into the intestine. If the graft/artery suture line breaks down, however, there is a risk of exsanguinating haemorrhage. The areas of intestine most commonly affected are the distal duodenum and the duodenojejunal flexure.

### Diagnosis

Gastrointestinal bleeding, whatever the volume, in a patient with an aortic graft should raise the suspicion of a connection between the graft and the small intestine. The bleeding may be occult or modest, the so called "herald" bleed. An episode of melaena in these patients is therefore due to an aortoenteric fistula until proved otherwise.

The anastomotic aneurysm that causes the bleed is rarely palpable and the fistulous connection is often in the fourth part of the duodenum or upper jejunum, beyond the range of the gastroduodenoscope. Endoscopy is useful, however, because a source of serious bleeding in the stomach or proximal duodenum is excluded. Computed tomography may show an anastomotic aneurysm or collections of fluid and air around the graft, indicating infection.

### Management

The gut must be repaired and the graft removed. The aortic stump and distal vascular tree are oversewn, and viability of the lower limb is maintained by extra-anatomical axillofemoral grafts, which avoid the infected abdominal cavity.

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Mr P Rutter, FRCS, is senior registrar in surgery, St Mary's Hospital, London, and Mr John H N Wolfe, FRCS, is consultant vascular surgeon, St Mary's Hospital, London.

The ABC of Vascular Diseases has been edited by Mr John H N Wolfe.

## MIRROR OF MEDICINE

Homoeopathy is another medical "heresy" of German origin, having been elaborated by Samuel Hahnemann (1755-1843), a German physician who studied medicine at Leipzig and Vienna. Its basis is treatment with minute quantities of drugs capable of producing the symptoms of the disease treated. Today homoeopathy is often regarded as being "among the more respectable systems of fringe medicine." In the nineteenth century it "represented a reaction to medical authority—both to unsatisfactory allopathic therapeutics and to the allopathic establishment." A *Journal* correspondent, for example, saw the rise of homoeopathy as a reaction to over drugging by the regular profession. In the 1850s and 1860s the *Journal* evinced considerable hostility towards homoeopaths, whom it regarded as merely another species of quack, although many of them were regularly qualified. Dr Hahnemann, for instance, whom it referred to as a "Saxon peasant" and "German trickster," was better educated and qualified than most *Journal* readers. This hostility can be explained in terms of a desire to protect the public; hence the *Journal* repeatedly insisted that: "the profession . . . have no reason to oppose homoeopathy, except from the knowledge of its utter inutility . . . we have no interest in

the matter, except, as we all have, to arrive at the truth." But undoubtedly there was also concern about losing patients and revenue.

The *Journal's* attacks on homoeopathy began in 1850, by which time the system had enjoyed a decade of expansion, and continued regularly for many years. In October 1850 news of a proposal to open a homoeopathic hospital called forth the *Journal's* scorn against the "monstrous absurdity" and "perniciousness" of "a practice . . . opposed to reason and common sense." The suggestion was that the government should jettison the laissez-faire ideology which permitted the individual "to be done to death in any way he may think proper." In 1851 a leading article expressed concern that St Andrews University should have awarded a degree of MD to a gentleman practising in Norwich as a professed homoeopath.

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